

NATURAL RESOURCE DEVELOPMENT POLICY:

AN AMENDMENT TO THE LAND USE PLAN OF PAMLICO COUNTY,
NORTH CAROLINA

NC Coastal Zone Management Program

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INTRODUCTION

Pamlico County is blessed with a great many natural resources: clean air, good agricultural land, a good water supply, forests, productive wetlands and estuaries, varied wildlife, abundant natural beauty, and peat and phosphate deposits.

The economic, social and spiritual well-being of the people of the county has depended on sustaining the quality and quantity of these resources since the county was first inhabited.

This dependence is expected to continue, and probably to increase, as the rising demand for food increases agriculture, aquaculture and fishing in the county and as the rising demand for recreational facilities increases second home development, recreational fishing and recreational boating in the county.

The development of each of these natural resources is related to all of the others and can have an immediate, serious, and long-lasting impact on one or more of the others. Impacts on the local economy can be easily measured in fiscal or monetary terms, but impacts on the social and spiritual well-being of the people may be of equal or even greater importance even though they are difficult, if not impossible, to measure in fiscal terms.

It is the purpose of this report to describe the natural resources of the county, the processes by which peat and phosphate resources will likely be developed and the existing policy affecting that development process at the time the report was being prepared.

The report also contains a statement of policy regarding the development of the natural resources of the county (Note: This statement of policy

must be adopted by the Pamlico County Board of Commissioners before it has any official status.) and a discussion of options the county can explore to implement this policy.

Chapter One

NATURAL RESOURCES

Introduction

Pamlico County depends on its natural resources for its economic, social and spiritual well-being. There are a number of competing uses for the natural resources in Pamlico County. The decision to develop these resources should take into consideration the impact that development will have on the other resources of the county and the irreversibility of the development decision.

Agriculture, forestry, recreation, and fishing are the major income producers in the county. As each activity increases and affects the others there are trade-offs involved. Much of Pamlico County exists today as it always has. It is the scenic beauty of the county's open lands and miles of coast that make it attractive for recreation and wildlife habitat; it is the undisturbed estuaries and clean waters that make commercial fishing possible and profitable; and it is the rich soils that make it successful farming country.

But in addition to providing revenues in the county, Pamlico County's natural resources make the area an attractive and comfortable home for its residents.

Part I of this report is an inventory of natural resources in the county: what resources are present, in what amounts, and where.

A. Soil

Agriculture is a major economic activity in Pamlico County, occupying the most land after forest lands. Predominant soil associations suitable for farming within the county are Lenoir-Leaf and Portsmouth-Woodington (see map number 1). Both soil associations consist of nearly level uplands which are moderately well-drained with low flooding potential. In 1978, 42,597 acres of land in the county were being farmed which yielded gross crop and livestock receipts of \$10,761,000 (1978 Census of Agriculture, 1980). The average farm size was 174 acres.

Yield per acre for corn, soybeans, Irish potatoes, and tobacco, the major cash crops, has historically been higher for Pamlico County than for the state as a whole:

	<u>North Carolina (1980)</u>		<u>Pamlico County (1980)</u>	
	<u>Yield Per Acre</u>	<u>Acres Harvested</u>	<u>Yield Per Acre</u>	<u>Acres Harvested</u>
Corn	60 bu	1,730,000	103 bu	10,300
Irish Potatoes	133 CWT	16,700	130 CWT	2,600
Tobacco	2,011 lbs	378,800	2,080 lbs	690
Soybeans	18.5 bu	1,930,000	27 bu	22,400
Wheat	35 bu	300,000	45 bu	4,600

Yield per acre in Pamlico County as compared to the other central coastal counties is shown in Table 1.

Map 1

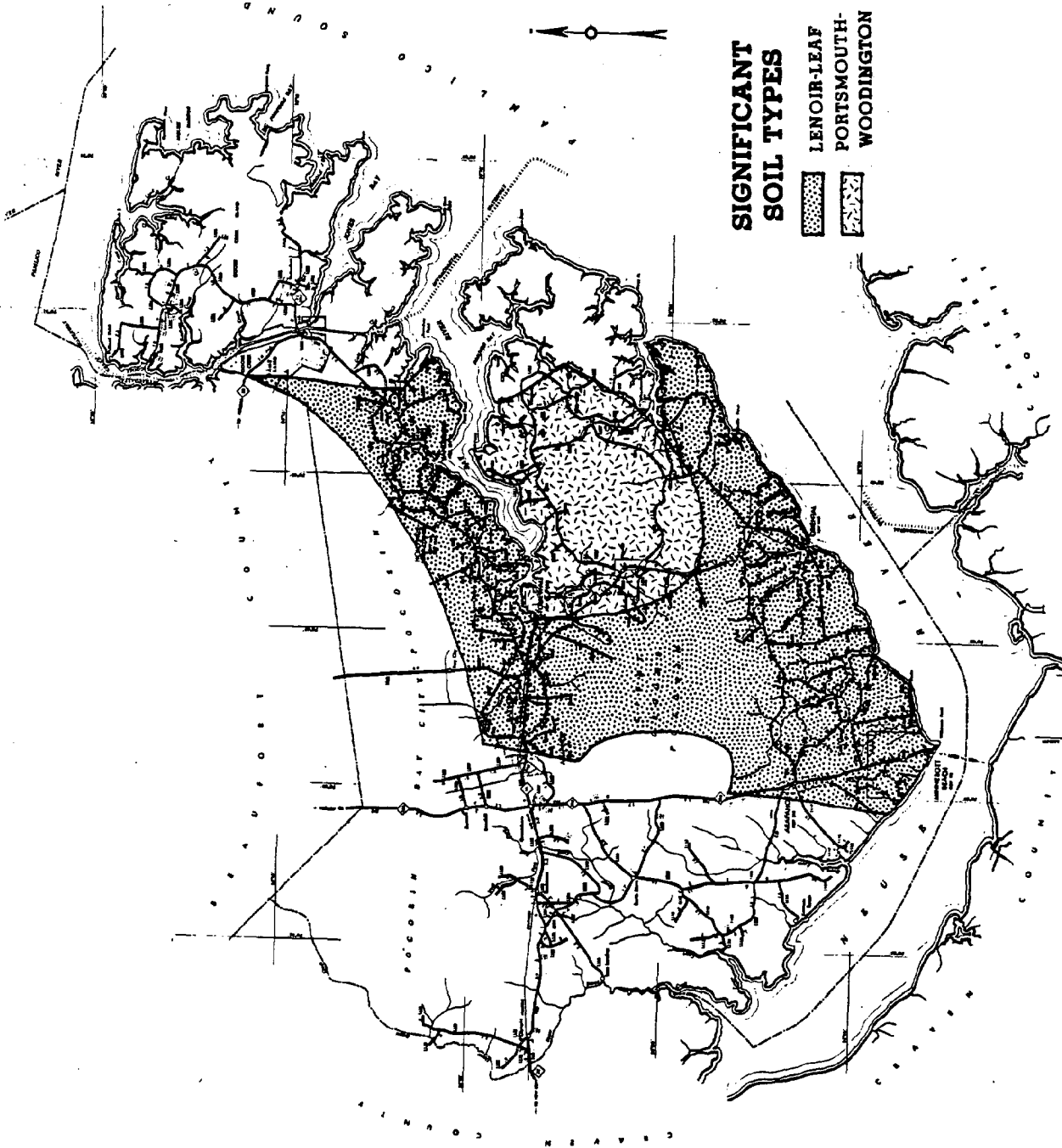


Table 1
CENTRAL COASTAL COUNTIES
1980 PRODUCTION

	Yield per Acre				
	<u>Irish Potatoes** (CWT)</u>	<u>Corn (BU)</u>	<u>Tobacco (LBS)</u>	<u>Soybeans (BU)</u>	<u>Wheat (BU)</u>
Beaufort	145	73	2,180	24	50
Carteret	145	75	2,085	23	*
Craven	150	51	2,030	18	36
Greene	*	56	2,185	23	50
Hyde	*	103	---	29	38
Johnston	90	49	2,215	15	36
Jones	*	82	2,065	22	36
Lenoir	*	64	2,180	20	41
Pamlico	130	103	2,080	27	45
Pitt	*	54	2,125	18	37
Wayne	125	64	2,310	22	40
Wilson	140	49	2,245	15	39

*Less than 50 acres in production.

**Pamlico County is the second leading county in the state in the production of Irish potatoes (2600 acres in production). Pasquotank is the leading county (2800 acres in production).

B. Forests

Four major commercial timber companies own land in Pamlico County:

	<u>Land in Acres</u>
Weyerhaeuser	20,660.92
Pamlico Timber	16,336.0
International Paper	11,100.07
Taylor	<u>14,051.20</u>
Total	62,148.19

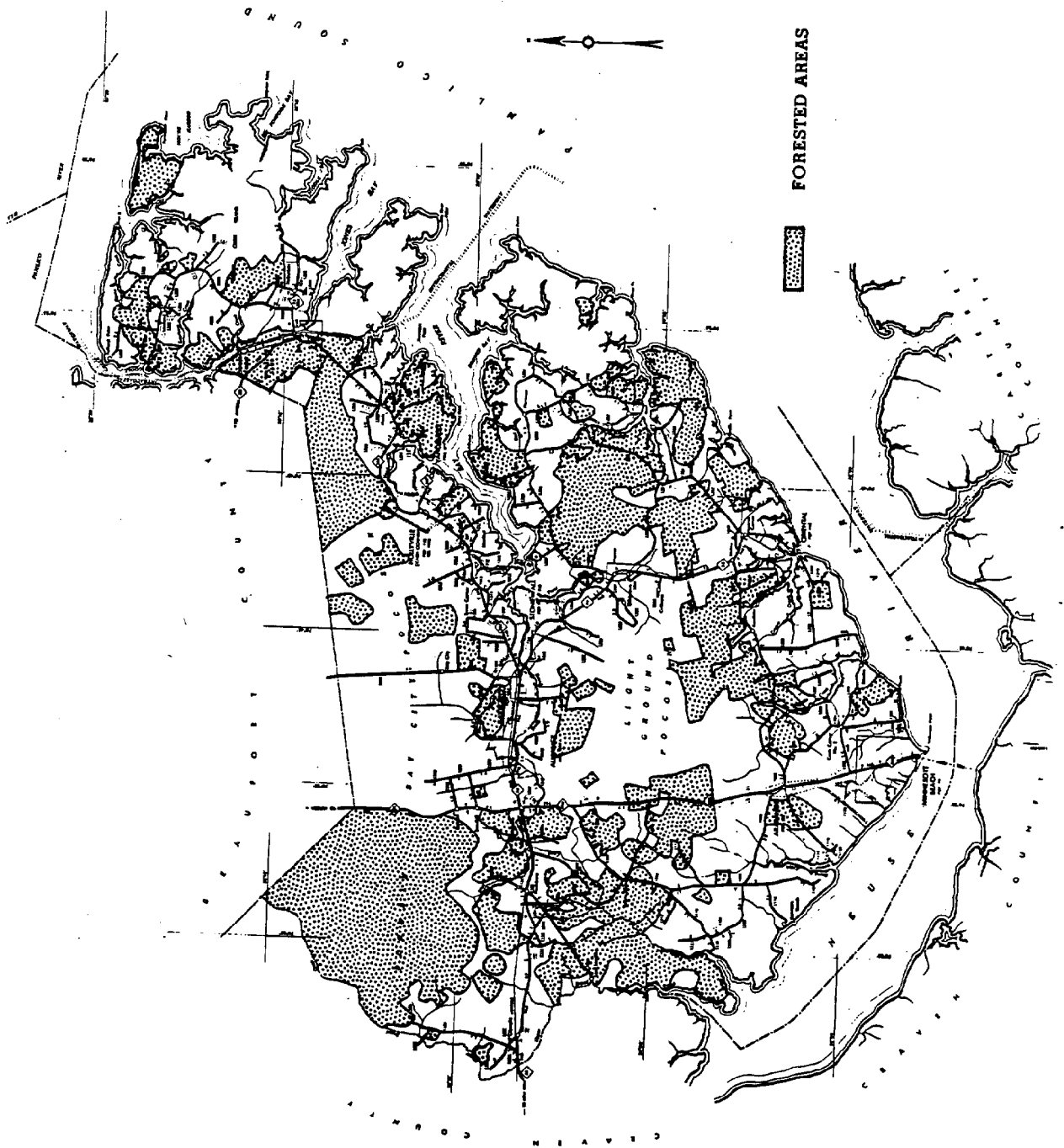
Forestry, along with farming, is an important Pamlico County economic activity. Forest plantations are becoming more prevalent in the area as land clearing increases. Tree farming is becoming popular with area farmers. When drained and cleared, pocosin lands make suitable loblolly pine farms.

Forest Service data for Pamlico County (1974 data--most likely unchanged) shows a total of 147,115 acres of commercial forest land (see map number 2). In 1979, Pamlico County lands yielded 4,149,000 board feet of sawtimber and 29,807 cords of pulpwood.

C. Water

Commercial fishing in Pamlico County produced a 1980 catch of 21.4 million pounds, and gross sales of \$9,736,730. Primary fishing ports in the county include Bayboro, Hobucken, Lowland, Oriental, Pamlico, Vandemere, and Whortonsville. Hard crabs in the Pamlico Sound have been of major importance for years. Total 1980 landings for hard crabs, in North Carolina, were the highest ever.

Map 2



D. Recreation

Pamlico County has 348 miles of bay and estuarine shoreline. The 348 miles is further divided into 51 miles of beach shoreline and 297 miles of non-beach shoreline. Two miles are classified as public recreation and ten miles for private recreation. Twenty-nine bays, rivers, creeks, and streams are considered to be trust waters. Their use is generally restricted to fishing and boating.

The beauty of the county and the surrounding water attracts thousands of visitors to the region year-round. The recreational use of these areas for sport-fishing, pleasure-boating and other water-oriented activities is very important to the county. The ports of Oriental and Minesott Beach attract sailors, water skiers, fishermen and other vacationers.

Second home development has followed recreational development as people choose to spend more and more time in the county. The county generally encourages second home development and tourism to the extent that it will not damage the natural resources that attract the visitors.

E. Wildlife

The Natural Heritage Program of the state Department of Natural Resources and Community Development is in the process of inventorying the natural areas and areas of ecological significance in Pamlico County. The study is scheduled for completion in August 1982, but in the absence of this definitive study it is obvious that there are many valuable and beautiful natural areas in the county.

Hunting in the county consists of hunting wild ducks in the salt marshes and also some bear, deer, quail, marsh hens, etc. There is a wildlife refuge near Hobucken.

The coastal area in general is important to the state as habitat for many game species. For example, coastal counties support much of the deer population. In a state ranking of high, moderate, low or few, Pamlico County is considered to have a moderate distribution of deer.

Many endangered or threatened species are critically dependent on wetlands. Other species recognized as needing protection and who are dependent on lowlands include bobcat, cougar, osprey, and otter.

Economic values of wildlife and wildlands are not easily quantifiable, but evidence indicates that they contribute significantly to the economic base as well as to the quality of life in Pamlico County. For example, the North Carolina Wildlife Resources Commission estimates trapping to be at least a \$10 million business in North Carolina. Fur harvest reports show that the 12 coastal counties of Beaufort, Bertie, Carteret, Craven, Dare, Hyde, Jones, Martin, Pamlico, Pitt, Tyrrell, and Washington produce 17 percent of the state harvest of muskrat, 32 percent of the state's harvest of nutria, 16 percent of the state's harvest of mink, and 15 percent of the state's harvest of otter.

The U.S. Fish and Wildlife Service in cooperation with state wildlife resource agencies undertakes a national economic survey every five years. The latest report is for 1975, and showed that North Carolina hunters and fishermen spent over \$746 million in North Carolina during that year. Hunting and fishing revenues for the 12 coastal counties contributed \$90 million to local economies; an additional \$3.5 million is generated by hunters and fishermen in state and local taxes within the coastal counties.

F. Oil and Natural Gas

A series of exploratory wells were drilled east of Highway 55 near Gibbs-town by Carolina Petroleum in 1947, but no deposits were discovered (see map number 3). No wells have been drilled since 1947, and there is no indication that oil or natural gas exist in the county.

G. Peat

The state has about 1,000 square miles of peatland (640,000 acres) containing 600 million dry tons of peat. North Carolina's major peat deposits are located in evergreen shrub bogs called pocosins. Pamlico County contains one major peat deposit and a portion of another. The Light Ground Pocosin peat deposit located in the south central part of the County includes about 9.26 square miles and contains about 5.2 million tons of moisture-free peat. The Gum Swamp-Bay City Pocosin located on the border of Pamlico and Beaufort Counties includes about 6.8 square miles and is underlain by peat in varying thicknesses.

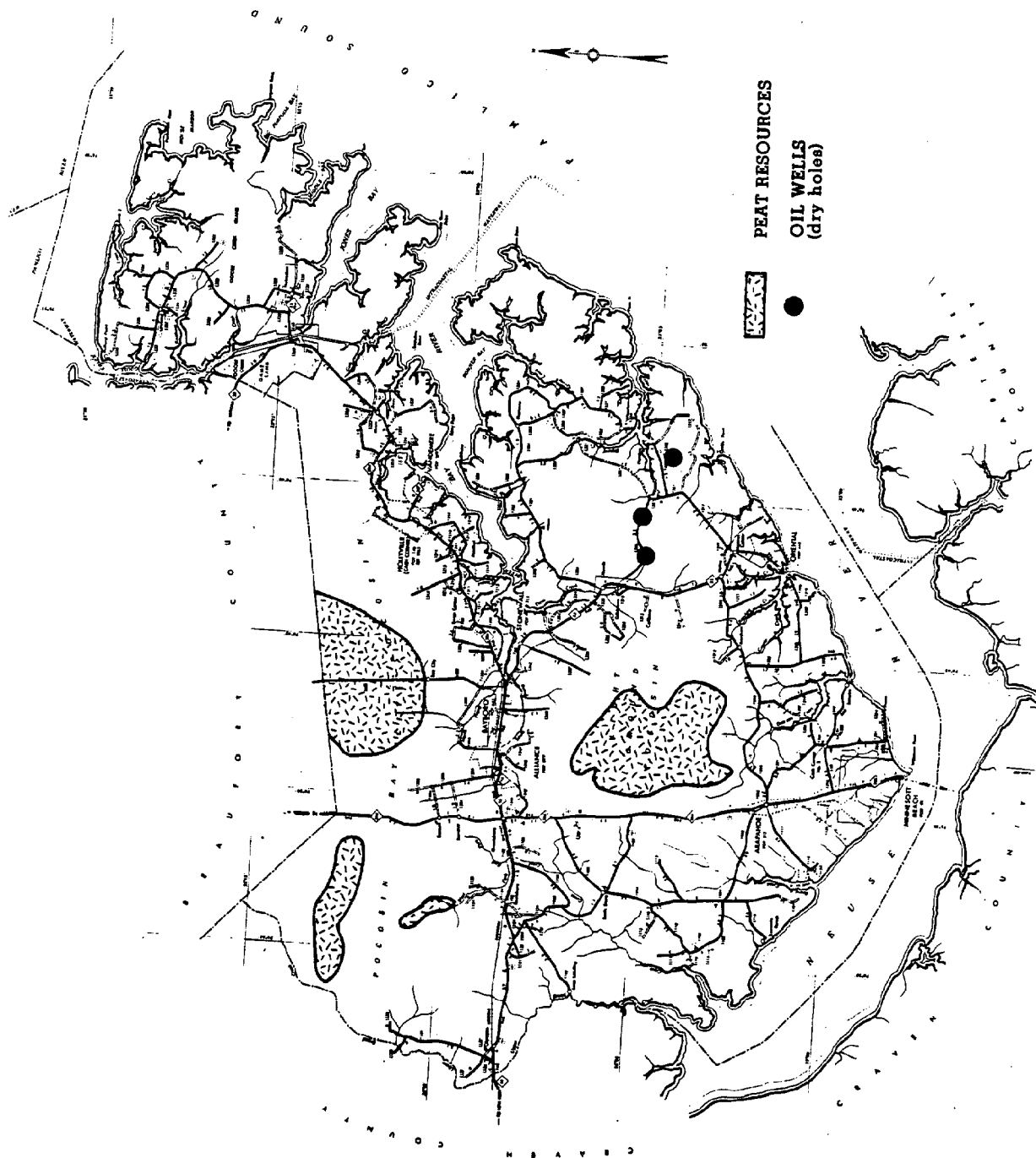
The Light Ground Pocosin is, by size, composition, and thickness, the more valuable deposit (see map number 3). The peat deposit averages about 4 1/2 - 5 feet deep, but ranges from 2 to 12 feet deep. The heating value ranges from 9,800 to 10,999 btu/lb, with a median of 10,500.

The peat in the Gum Swamp-Bay City Pocosin is less likely to be mined than the Light Ground Pocosin. The deposit is broad and shallow, its average depth ranging from 2 to 4 feet. The average heating value is 9280 btu/lb.

H. Phosphate

Phosphate deposits that are attractive targets for present-day mining techniques occur in eastern North Carolina within a sedimentary rock unit

Map 3



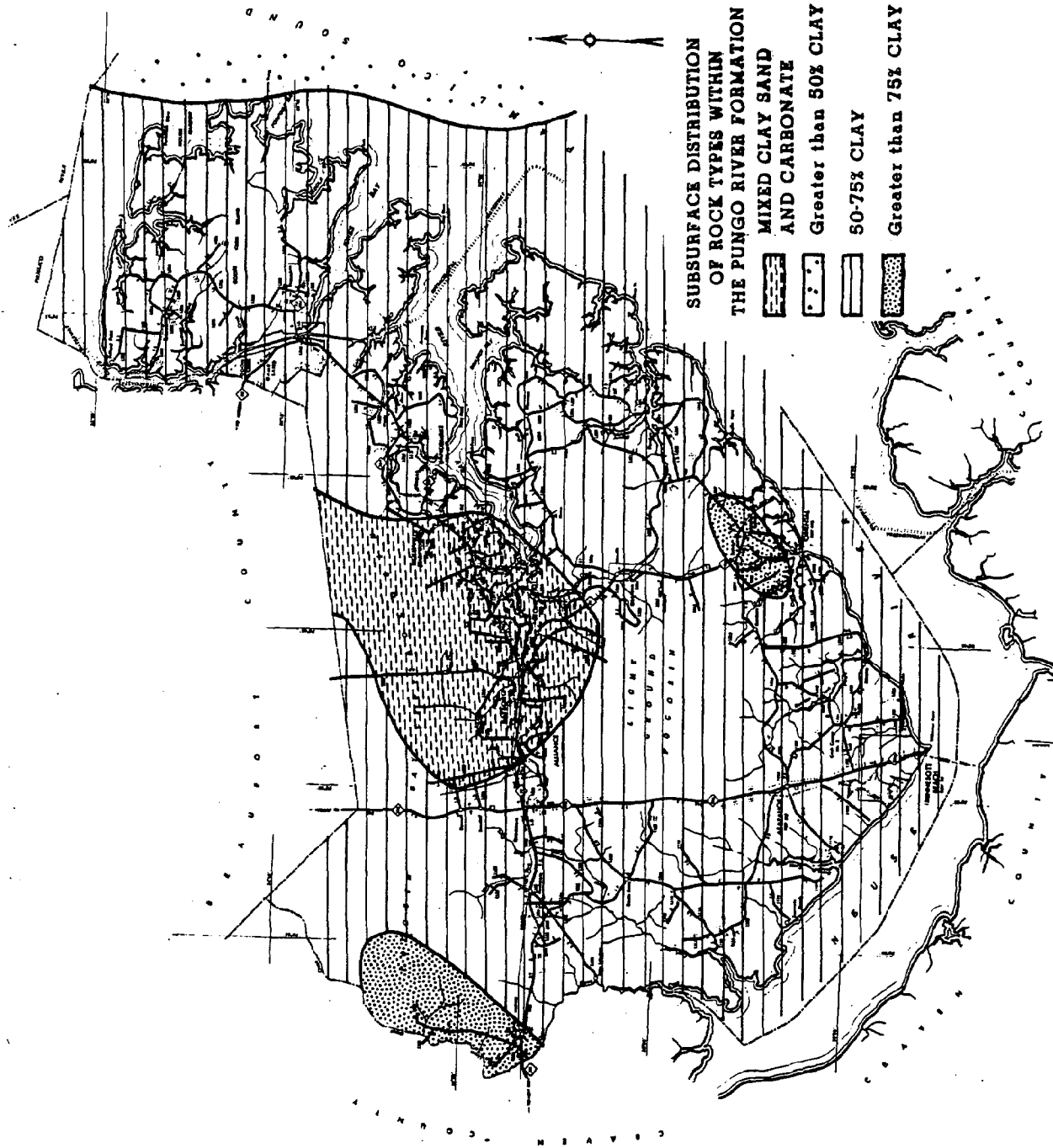
called the Pungo River Formation. The thickness of the rock unit, the depth to which it is buried beneath overlying sedimentary rocks, and the distribution of rock types that comprise the Pungo River Formation are factors that must be considered when evaluating the potential for phosphate mining in Pamlico County.

In Pamlico County there are four rock types (facies) of the Pungo River Formation:

1. Greater than 75% sand; high-grade phosphate deposits
2. 50-75% sand; medium-grade phosphate deposits
3. Greater than 50% clay; low-grade phosphate deposits
4. Mixed clay, sand and carbonate; low-grade phosphate deposits.

Map number 4 shows the distribution of the four facies of the Pungo River Formation in Pamlico County.

Map 4



In general, the Pungo River Formation becomes thicker toward the northeast. In the Aurora area present mining activities are being conducted where the Pungo River Formation is from 60 to 80 feet thick. Map number 5 shows the subsurface thickness of the Pungo River Formation in Pamlico County.

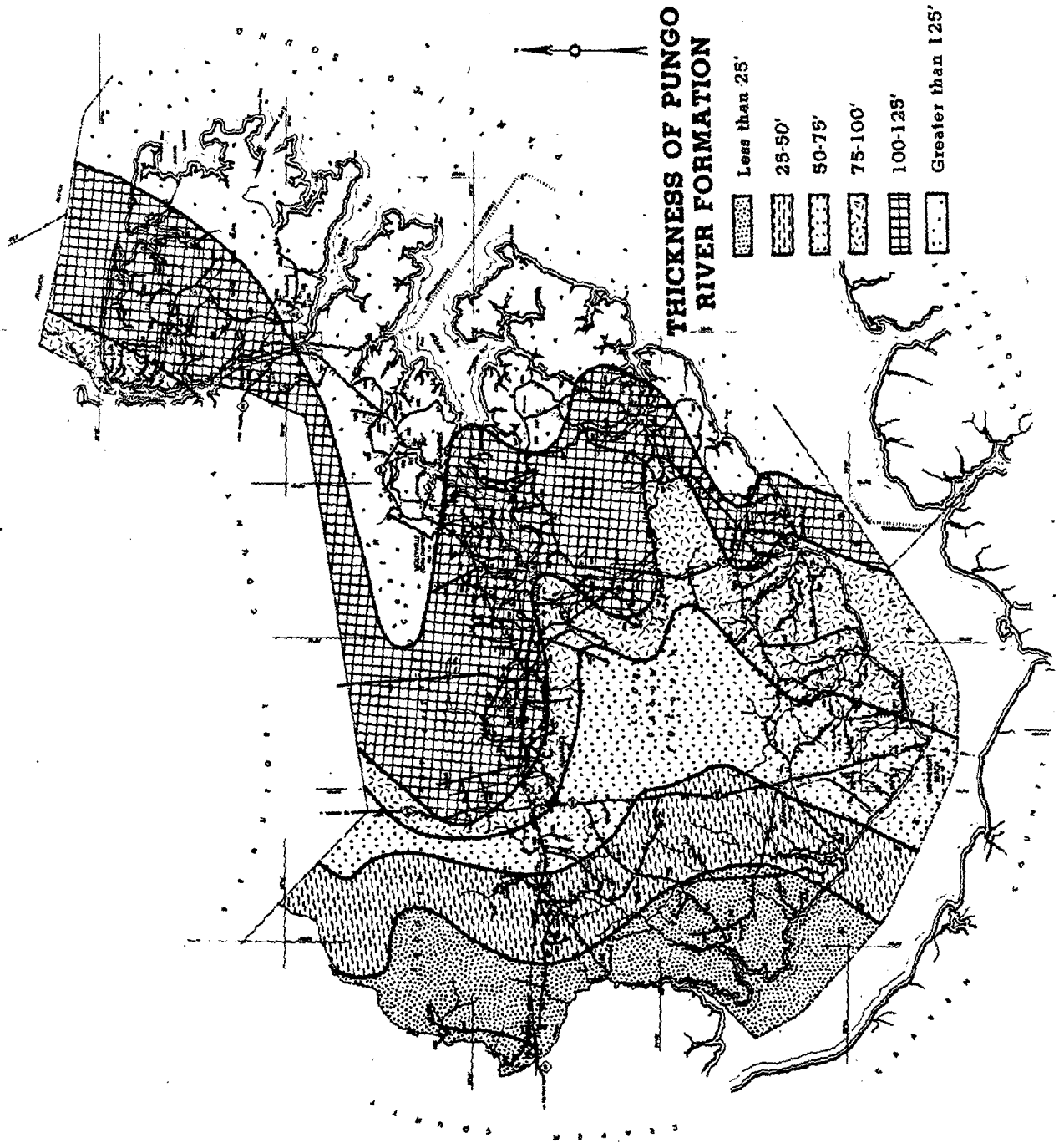
The depth to which the Pungo River Formation is buried beneath younger sedimentary rocks generally increases toward the east in Pamlico County. In the Aurora area present mining operations are being conducted where sedimentary rocks overlying the Pungo River Formation are 60-80 feet thick. Map number 6 shows that the Janerio Area has the least amount of overburden.

The data available for determining the quality, thickness, and overburden of phosphate in Pamlico County is based on 24 data points in a land area of approximately 335 square miles. To properly evaluate the potential of phosphate resources in Pamlico County would require a study similar to that done by J.O. Kimrey in Beaufort County (257 data points in a land area of approximately 830 square miles).

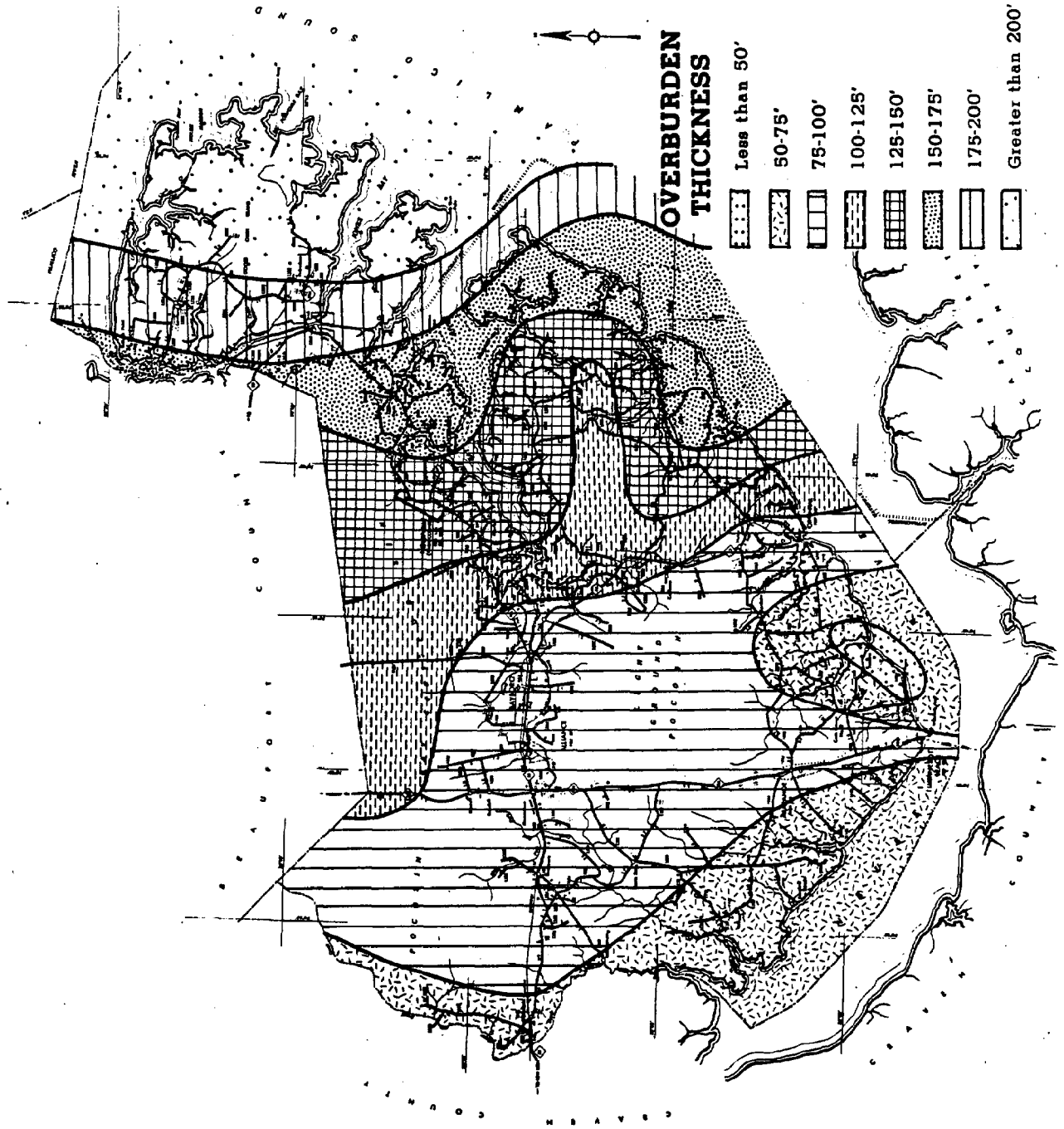
The data presented here must be viewed within the framework of present economic conditions in the phosphate market and advances in mining technology. According to discussions with North Carolina Phosphate Company and Texasgulf, two companies presently mining in Beaufort County, it is unlikely that mining operations will occur in Pamlico County before 20-30 years in the future. Mining technologies and the market for phosphate will change a great deal. Phosphate not presently mineable may be accessible in years to come.

North Carolina Phosphate Company recently purchased a large tract of which 2000 acres lie in Pamlico County. The entire tract of 33,000 acres has a present value of \$330 million. TexasGulf owns 16,336 acres in the northwest corner of the county. Growth pressures in Florida are forcing phosphate

Map 5



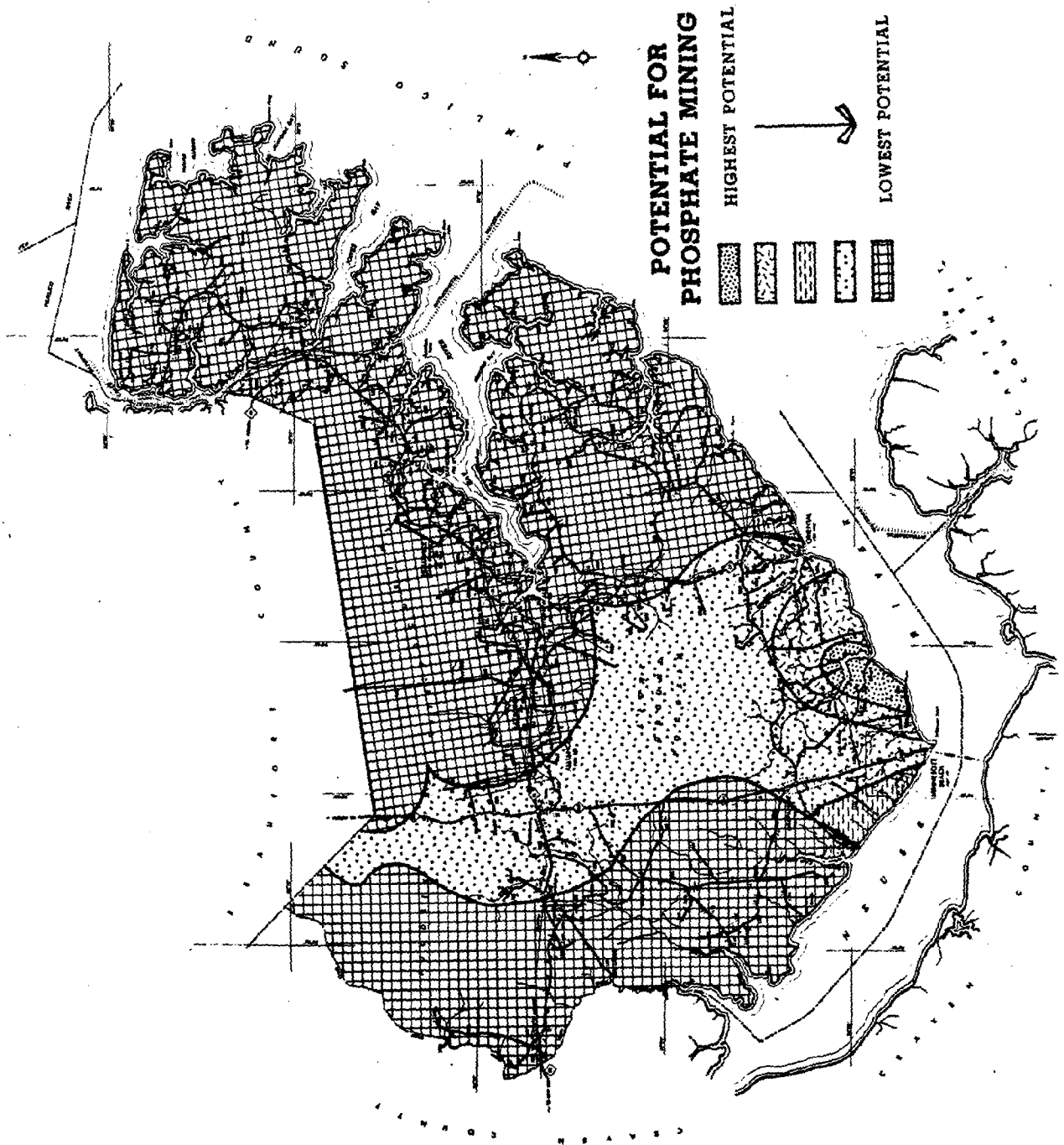
Map 7



interests in that state to look elsewhere. North Carolina looks highly attractive to these companies. A change in technology or economic conditions could bring a new company into the area sooner than predicted by already established phosphate interests in North Carolina.

Map number 7 incorporates data shown in maps 4, 5, and 6. Areas are designated to suggest the potential for phosphate mining in Pamlico County.

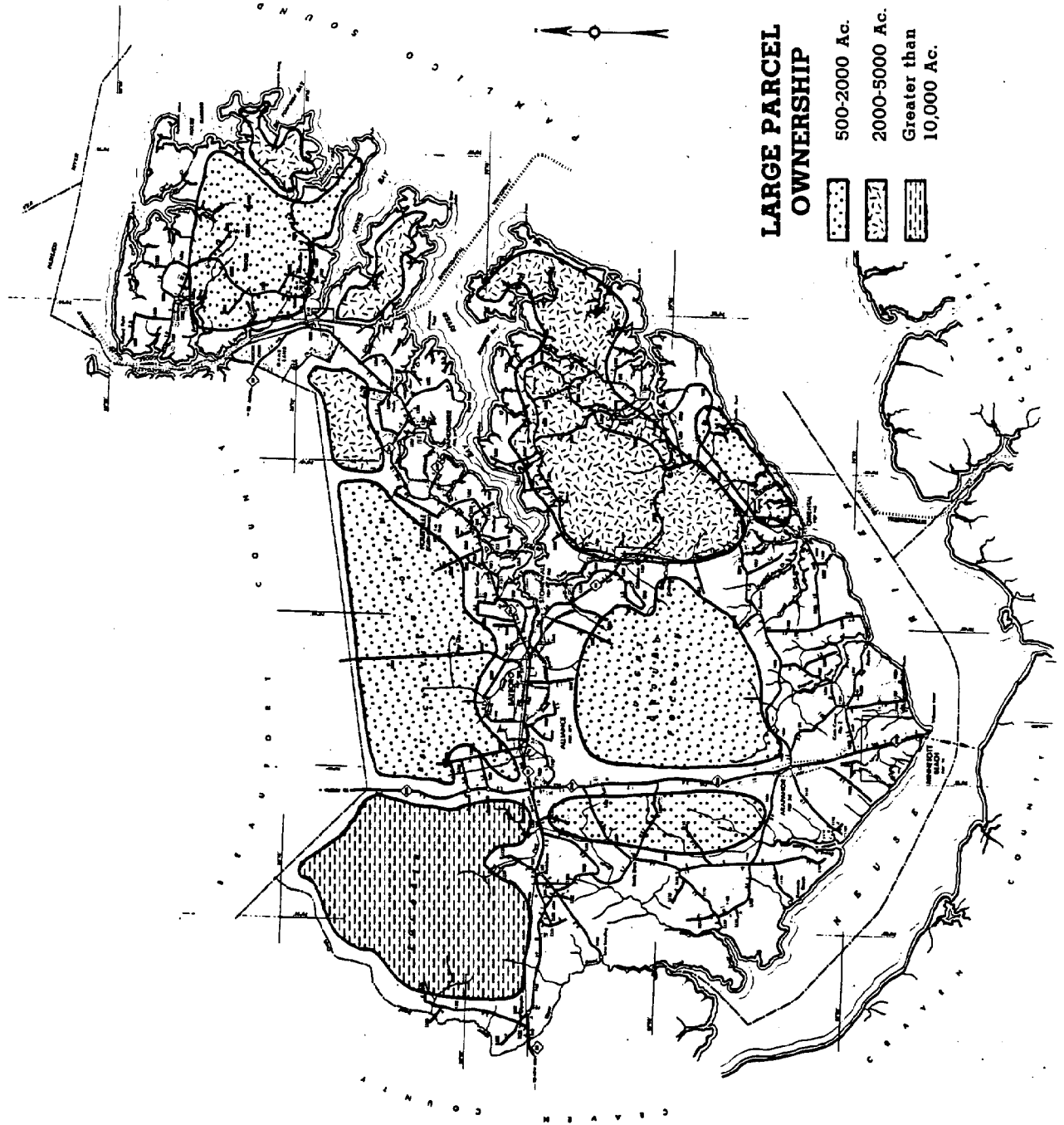
Map 7



1. Land Ownership Patterns

A relatively large proportion of the land area of Pamlico County is owned by a relatively small number of owners (see map number 8). This means that these areas are often more easy to develop because the developer does not have to assemble the land area required by negotiating with the owners of a number of smaller parcels.

Map 8



Chapter 2

PEAT HARVESTING

Introduction

The peatlands of eastern North Carolina are among the least appreciated of all wild areas. Peat is an accumulation of undecomposed or partially decomposed remains of grasses, trees, mosses and other marsh and swamp plants in a wet environment. Anaerobic conditions prevent fungi and bacteria from decaying the organic material as they ordinarily would. Peat accumulates at a rate of about three inches a century.

Peatlands have generally been considered worthless. Farmers have found that once the timber and vegetation is removed, peatlands provide an excellent growing medium. But peat also has a high potential for energy production. As a result, energy companies, large farming corporations and the federal government are exploring ways to develop and use the peatlands.

Four state peat mining permits are active though no market has been found for peat.

There are a number of environmental problems associated with peat mining. These wetland areas perform roles that are barely understood in sustaining wildlife and protecting freshwater and saltwater estuaries. Dr. Eville Gorham, a wetlands specialist at the University of Minnesota, has called peatlands, "the most delicate adjustment of vegetation to hydrology and water flow known to man."

In this section on peat harvesting a brief description of the technology of mining is offered, followed by discussion of the environmental and socio-economic impacts of peat mining.

A. Technology

The technology for clearing and draining peat lands in preparation for harvesting is similar to that for agriculture, and if properly done the eventual use of the land may be agricultural.

The first phase of converting peat lands requires artificial drainage consisting of three steps: primary drainage, secondary drainage, and grading. The primary drainage system consists of catcher, outfall, and transportation canals. Catcher canals are spaced about a half mile apart and empty into transportation or outfall canals which in turn empty into a local drainage outlet.

The secondary drainage system consists of field ditches located perpendicular to catcher canals at intervals of about 160 feet. These ditches collect surface and subsurface waters and carry them to the primary drainage system. The primary and secondary drainage system canals form rectangular fields which, if they are to be farmed after the peat has been harvested, are leveled to remove potholes and depressions and graded in two directions at a 0.5 percent slope away from a crown in the center of the field toward the drainage ditches.

Phase two involves the clearing of existing cover vegetation including harvestable timber, other trees, brush, and buried wood. This is accomplished by bulldozers using blades and rootrakes. The remaining vegetation is then pushed into windrows which are periodically burned and reiled until, after a number of years, they are eliminated.

Peat is next removed from the land by harvesting a one-foot deep layer and laying it on the ground to dry to between 30 and 50 percent moisture content. Harvesting methods include: (1) milling, whereby the top 4 to 10 inches are disturbed and left to dry for a few days, and picked up with a vacuum or conveyor harvester 1 to 2 inches at a time; (2) sod cutting, whereby a wheel cutter (saws) removes chunks and extrudes them through an auger back onto the field for drying and recovery. Both methods are used depending on the condition of the land, i.e., how much wood and brush is present. When the peat drying has been completed, the peat is removed from the field. This process continues for a period of 4 to 5 years until the 4 or 5 feet of usable peat, on the average, has been harvested.

In many cases, stripping the peat will create shallow pits. These will often lie below the existing water table, causing the ground to become soaked most of the year. The remedy is the continual pumping of water up to higher level canals where it can flow away by gravity. This need for perpetual pumped drainage increases the costs of farming the land after stripping is finished. This cost, though, may often be offset by the general high agricultural productivity of the soils exposed by stripping.

B. Market

Surveys have been conducted, products have been analyzed, and markets reviewed in North Carolina to determine whether peat is a competitive source of energy with a market in this region. Four state permits are active, and two more are pending. Peatco in Pamlico County has received its permit. Clearly the peat in North Carolina can be mined. The question is whether peat mining can show a profit within today's costs and sales.

The recent state peat mining task force concluded a market was developing:

There is not yet an established market for North Carolina peat, but a major market is expected to develop within five years as proposed methanol plants and peat-fired generating plants are built. The first peat sold, perhaps within six months (from March 1981) will probably be bought by Weyerhaeuser to fuel its new boiler at Plymouth.¹

The value of peat cannot be based on market prices as a peat fuel market does not presently exist in the United States. In Finland, where peat is commonly used as a fuel for generation of electricity, prices range from \$12.00 to \$14.00 per ton delivered. North Carolina peat has less moisture and a higher BTU content than Finnish peat (Richardson, ed., 1981).

A peat fuel price can be determined by deriving a price at which peat would be commercially competitive when compared with high sulfur coal. Peat and high sulfur coal are similar in that both are bulky, solid fuels and have high volume ash residuals.

Using the example of coal vs. a peat-fired boiler, a comparison is made between the two fuels. The cost of producing electricity using high sulfur coal has been estimated to be \$308/kwh (RTI, 1979). Using this final production cost and taking the estimates of fixed costs, operating and maintenance costs, and thermal efficiency for each fuel, the price of peat fuel can be derived given the prices of all other fuels. The value of peat calculated in this manner is \$13.73/ton (Richardson, ed., 1981). Using this derived price to value peat fuel, the annual benefits from mining sufficient peat to operate a 125 mw peat-fired utility boiler, 92 tons per hour, is approximately \$8.8 million per year; on a per acre basis, the benefits of peat mining would be approximately \$13,000 per acre (benefit stream over five years discounted at 8 percent).

There is some concern by First Colony Farms, Inc. (FCF) in Creswell, North Carolina, that the above figures do not adequately reflect a real value for peat. FCF has begun mining peat on an experimental basis (300 acres). Thus far they have argued that the figures for peat are low. Again, it is difficult to determine a value for peat when no market exists.

A final comment about peat fuel value concerns the time frame of this benefit stream. The planned life of a utility boiler is typically around thirty years. Therefore, the annual benefits will flow for thirty years and then drop to zero. All other benefit streams discussed in this study flow indefinitely in that they do not result from the consumption of the resource.

Peat Methanol Associates (PMA) announced plans in June 1981 to build a plant to convert peat into methanol at First Colony Farms near Creswell in Washington County. The plan is contingent on private financing and a federal guarantee that the methanol would be sold for at least 75 cents a gallon. The company hopes to extract 156,000 gallons of methanol from 2,123 tons of peat a day by 1984.

The quality of the peat mined in this state is adequate for use as an industrial fuel and can be used in wood-fired boilers with few problems. While peat is far bulkier than coal, its BTU content, pound for pound, is comparable to Eastern Bituminous coal. Peat rates from near 10,000 to 10,500 BTU/lb. It is wet and heavy when it comes out of the ground, and even when dried to at least 50 percent (optimum 30 percent), it creates shipping problems. Because of its bulk, transport is expensive, and stockpiling and handling at the use point is somewhat cumbersome and bothersome.

Peatco, the company which has applied for a permit to mine peat in the Light Ground Pocosin, could supply peat to the methanol plant in Washington

County, but shipping problems would be a substantial obstacle. Their prices would not be competitive with those of FCF. The industrial boiler at the Weyerhaeuser plant in Plymouth is designed to burn peat as well as wood chips, oil, or coal, but so far, no other boilers in the vicinity of the Light Ground Pocosin are as well equipped.

C. Impacts

Economic

The economic impacts of peat harvesting will be limited in Pamlico County due to the existence of only one substantial deposit, the Light Ground Pocosin. There is peat in the Gum Swamp-Bay City Pocosin, but it is found in amounts and at depths which may not be economically feasible to harvest.

According to Peatco, estimates for employment at their peat harvesting site are 30 direct jobs and 30 indirect jobs--trucking, etc. These figures are based on a production rate of 400,000 tons of peat per year, but actual production will depend on demand. Production would be unlikely to occur unless there was a steady market for a minimum of 100,000 tons of peat per year. At that level direct employment would fall to 15-18 persons.

Both land clearing and peat mining activity would be continual and overlapping, and no distinction is made in the 30 direct jobs as to what activity is associated with each position. The work is largely unskilled, and no job training is anticipated. Employees are expected to come from within Pamlico County, however, according to Peatco.

Property tax consequences of land clearing, peat mining, and farming are based on conversion of woodlands presently assessed at \$80, \$100, or \$150 per acre, depending on quality. Land that now has canals and roads adequate for good forest draininage, fire control, and harvesting is classified "good",

less developed land is classified fair, and undeveloped land with poor drainage is classified poor. After peat is removed from the land, the cleared area may be taxed as farmland, if it is farmable, in which case the value increases by a factor of 2.5 to 5 times the current assessed value. Otherwise, the land will be assessed as woodlands or wasteland. Some of the deep organic buffer areas may be assessed as wasteland, but other parts of the buffer may contain fair timberland.

Transportation

Pamlico County does not have an extremely well-developed primary road system. Highways 55, 304, and 306 form the primary network in the county. Access is limited due to the confluence of the Neuse and Pamlico Rivers into the Pamlico Sound. The major access roads to the Light Ground Pocosin are Highways 55 and 306, two of the better roads in the county. At present the truck traffic on these roads is mostly farming equipment, fishing trucks, or trucks from light industry in the area. Present traffic counts are 4600 vehicles daily and 2000 vehicles daily, respectively.

One of the deterrants to industrial development in the county, cited by the 1980 land use plan for the county, is the lack of a major north-south transportation route. Ferries operate across the Pamlico and Neuse Rivers now, and although interest has been expressed in building a bridge across these two rivers construction in the foreseeable future is unlikely.

The District Engineer for the county foresees no problems with increased traffic on Highways 55 and 306 which would undoubtedly be used by Peatco to move the harvested peat to market. Secondary roads could be more of a problem since most roads leading out of the Light Ground Pocosin area are still unpaved.

Maintenance and improvement of county roads is the responsibility of the N.C. Department of Transportation and is funded by money allocated by the General Assembly. Funding is based on the amount of mileage of roads in the county, and not on existing or anticipated traffic counts.

Water

Peat mining itself and the eventual use of the site for agriculture, pose a number of water quality and water management problems. The major effects of clearing and draining property are fresh water intrusion, pollutants (including organics, nutrients, sediment bacteria, and toxics), and altering of basic hydrology.

Fresh water intrusion: No impact of coastal land conversion has been studied more than the effect of surges of fresh water into primary nursery areas of the estuaries. The estuary has long been documented as a dynamic system that is important for transporting eggs and larvae into primary nursery areas and permitting young organisms to remain in the nursery area. Heavy fresh water runoff, which occurs both in the clearing and drainage stages of agricultural land preparation and peat mining, appears to change the salinity of adjacent brackish estuaries and reduce the abundance of some commercially important species such as shrimp.

Approximately 35 miles of canals have already been dug in the Light Ground Pocosin to assist natural drainage. Most of the wetland appears to drain northward into the Bay River and Neal Creek. A small amount of water flows into Dawson Creek to the south and Greens and Trent Creeks to the east. The drainage plan for Peatco's proposed peat activity will result in water runoff from the peat fields being directed exclusively to Neal and Dawson

Creeks. The receiving waters of Dawson Creek are not classified as primary nursery areas since, when that classification was made, the Division was not classifying any inland waters. Dawson Creek is presently classified as "inland waters," but it is nevertheless known to be utilized by juvenile estuarine organisms which are economically important.

Pollution and Hydrologic Balance: Canals draining agricultural and forest lands speed the release of fresh water from the land into the estuaries. Development, swamp drainage, channelization, road construction, etc. in the major river basins increase stream discharge.

As the rate of runoff from land is increased, the ability of swamps and marshes to filter nutrients and pollutants is reduced. In addition, agriculture and silviculture, which use fertilizers and pesticides, increase the amount of pollutants that enter an estuary. It is probably safe to say that short-term pollution problems from clearing and ditch construction are not as severe as the continuing pollution from agricultural operations. A variety of pollutants from farmlands, tree farms, forest harvest operations, and peat mine sites are released continuously, including nitrogen and phosphorus, in significant amounts. Other pollutant problems include pathogens and other pollutant pesticides.

Sediment load is also increased with fresh water runoff. This results in suffocation of eggs and larvae as well as filling of nurseries. The canal networks draining agricultural and peat lands periodically must be dredged to remove the sediment built up due to upland erosion, windborne erosion, and local clearing activity.

Generally, when drainage systems are developed, it is estimated that the water table in the pocosin is lowered about three feet, from an average position of about one foot below land surface to an average position of about four feet below land surface. Available data shows that the water budget for the area remains essentially the same under natural and drained conditions; however, there is an important difference. The runoff element of the water budget before development consists of sheet flow over the land surface. After development, it consists of outflow through the artificial canals. While this aids in drying organic soils for agricultural purposes, it affects water quality in a manner not yet completely understood. Also, drainage causes organic soils to shrink and subside and can dry irreversibly because the ground surface cracks, forming clods that will not rewet.

Air

Air quality is a concern primarily because of the regional practice of burning windrows and timber during farmland and forest land clearing for most of eastern North Carolina, including Pamlico County. A new permit system run by the Division of Forest Resources has been instituted (G.S. 11360.22 - 11360.26). It sets up requirements for burning debris associated with land clearing. Generally, the volume depends on the percentage of organics and atmospheric conditions, and burning is restricted to the hours between 9 a.m. and 3 p.m.

A second air pollution problem that may arise is actually a water pollution problem. If sufficient wind breaks are not left in a field, pollutants, such as nutrients or pesticides attached to soil particles, can be carried by the wind into adjacent bodies of water. In certain cases, these pollutants can reach significant levels. Steps taken during the land clearing process and reclamation can ameliorate this problem.

Habitats and Natural Areas

Aesthetic--or visual--satisfaction is another value provided by pocosins. The scenic diversity and contrast which this unique landscape offers has psychological impacts which can be reflected in social and economic benefits. Presently, no monetary values have been placed on such benefits. Peat mining would totally change the character of the wetland and disrupt the natural diversity this habitat provides.

The present and projected rates of accelerated conversion to agriculture threaten the natural system of the coast with consequences for wildlife, ecosystem integrity, and the quality of the coastal landscape. The wetlands of the coast have created special types of wildlife habitats that are highly valued by the people of North Carolina. There is no public management system that exists to deal with the alterations taking place on coastal lands.

The rapid clearing and draining of coastal lowlands for peat mining and agricultural activity is eliminating a habitat for game species and other endangered species. The clearing process involves the complete removal of all existing vegetation thereby eliminating the habitat for certain wildlife species such as black bear, bobcat, and white-tailed deer. These species are then eliminated or reduced such that recreational hunting of them is no longer suitable. The black bear and bobcat could disappear from the area if the current rate of forest clearing continues.

There exists a strong possibility of the loss of unique vegetative communities and their wildlife populations. Existing populations of the red-cockaded woodpecker, the bald eagle, and possibly the cougar could be further reduced. Windrows, tree belts, areas retained in forestland and other planned management practices are prescriptions for using the land to protect these species.

A value should also be placed on the potential future use of pocosins. Leaving pocosins in their natural state does not foreclose the option of their conversion in the future. Pocosin lands have values in and of themselves and as the remaining portion of a rapidly diminishing resource. As more is learned about these lands, future generations may value them more highly. Given uncertainty about the role pocosins play in the coastal ecosystem in North Carolina, such an irreversible commitment of these natural areas must be carefully weighed.

Forestry

Forestry or silviculture is an alternative to agricultural use after the peat has been harvested from a pocosin. Intensive forest management would require much the same preparation of drainage systems as required for row crop farming, including peat removal. The land could provide a high yield of pine sawtimber and pulpwood if properly prepared, seeded and managed for 30 years.

Foresters have limited experience with silviculture on North Carolina's wetsoils, but companies like Weyerhaeuser expect extensive site preparation and silviculture processes to raise the annual yield of a pocosin-type forest. Burning of the woody materials that have been cleared from the land is the only present economical method of dealing with clearing residue. Energy costs to remove, chip, and transport this material presently exceeds its value as a fuel.

Management of pocosins like the Light Ground for timber production is not as detrimental to wildlife as agriculture is, but some similar problems occur. Pocosins that have been cleared, fertilized, and planted in pine are very productive for the first 4 to 5 years, providing abundant forage for deer, and grasses that give food and cover to small game. This situation changes, however, after the pines obtain dominance and shade out understory vegetation.

Agriculture

Once the peat is removed from a pocosin, the mineral soils left are well suited to corn and soybean crop production; but approximately 5 to 6 tons of limestone per acre must be added to the soils. Agriculture production yields on high organic matter soils are higher than state averages. One hundred and five to 130 bushels/acre for corn and 32 to 40 bu/acre for soybeans represent five year average yields on well developed soils. State averages comparatively are 60 to 80 bu/acre for corn and 18 to 24 bu/acre for soybeans. The effects of land clearing and row cropping on coastal lands though includes long-term pollution from pesticides and fertilizers, fecal coliform from animal pastures, and sedimentation from runoff problems. Alteration of the land use and lowering of the land level has a significant effect on the character of the area. A system of canals must be maintained to provide adequate drainage. This continual drainage must be monitored and regulated to prevent major changes in fresh water flows into coastal estuaries.

Row cropping and tree farms also produce little habitat diversity and therefore do not encourage wildlife diversity.

Chapter 3

PHOSPHATE MINING

Introduction

Interest in phosphate ore in Beaufort County and surrounding Pamlico and Hyde counties arose in 1951 when American Metals Company started exploration for phosphate. They failed to make any discovery of a commercially valuable body of ore.

In 1959, Texasgulf looked at North Carolina phosphate but considered the mining cost prohibitive at that time. But in 1961, Sun Oil brought up the first tonnage quantity of North Carolina phosphate. By the mid-1960s, Texasgulf and others showed a renewed interest in phosphate mining.

Two main problems have beset the North Carolina phosphate development from the beginning. The first problem is mining a deposit which is below sea level which is near an ocean connected waterway. It is overlain by 50 to 200 feet of overburden and underlain by a major artesian aquifer, the Castle Hayne Formation.

The second problem is the production of a high grade phosphate concentrate from the ore without dilution by other sand, shell, and lime stones which is found in some sections of the ore.

By 1980, Texasgulf's deposit in Beaufort County yielded 4.3 million tons of phosphate worth \$107.5 million. Any technological problems that had plagued early mining operations had been alleviated or substantially reduced.

Pamlico County contains phosphate deposits, but the thickness of the rock, the depth to which it is buried, and its distribution make its present mining unlikely. But new mining techniques are being developed which would make Pamlico County's phosphate deposits commercially valuable.

The following discussion centers on present mining techniques and the impacts of these techniques, and what new methods are being studied which might make Pamlico County's deposits valuable, sooner.

A. Technology and Methods

There are two quite distinct methods of mining phosphate of the type and location of that in coastal North Carolina. The first and clearly predominant method is a form of strip mining. This involves the removal of the ground covering the mineral (overburden) and then removing the phosphate itself. Once the overburden is removed (there are several different methods of doing this), draglines scoop up the ore in large bites and pile it on the bench of the mine. There, high pressure jets of water are used to form a slurry, a mixture of sandy ore and water.

The slurry of phosphate ore is pumped through a long pipeline to the mill. There, the ore is screened to remove large particles and then washed to remove clay and silt.

The next step is flotation, a process where quartz sand is separated from the phosphate sand. The quartz sand and silt are returned to the mined area as landfill. The phosphate sand--called phosphate concentrate--is either dried or calcined.

Calcining the rock involves roasting it at about 1500°F. This helps to purify the product by removing organic compounds, carbon dioxide, and water.

Most of the calcined phosphate rock is used as feedstock for the phosphoric acid plants. The remainder can be sold to customers in bulk.

Borehole mining, also known as slurry mining, is a second process for removing phosphate. A tool incorporating a water jet cutting system and a downhole slurry pumping system, mines minerals through a single borehole drilled from the surface to the buried mineralized rock. Water jets generated

in the mining tool erode the ore and form a slurry. The slurry flows into the inlet of a slurry pump where it is lifted to the surface and into an ore bin. The bin collects the ore while allowing the water to flow into a pond. This pond acts as a source of water for a series of pumps which supply water to the cutting jet and the downhold slurry pump.

To date this tool has been successfully used to mine coal and uraniferous sandstones on an experimental basis. Future experimental mining operations include extraction of oil sands and phosphates. One of the benefits of the system is that small or erratic deposits can be mined; whereas it might be cost-prohibitive to stripmine these areas. Environmental impacts thus far are shown to be minimal. No overburden is removed. Groundwater quality is normally not impaired.

Slurry borehole mining is an outgrowth of U.S. Bureau of Mines research begun during 1973. It promises to be an attractive method for extracting oil sands and other underground ore deposits. It has the advantages of minimizing surface disruptions, waste rock piles, damage to ground water quality and hydrology, and surface water pollution. One serious problem, subsidence of the ground above the mine cavity, is being ameliorated somewhat by backfilling of the cavities.

During the summer of 1980, this borehole mining and backfilling technique was successfully demonstrated by the Agrico Mining Company in St. Johns County, Florida. Agrico is the parent company of North Carolina Phosphate Corporation which is developing land in Beaufort County and owns land in Pamlico County.

In Agrico's application, 1800 tons of phosphate rock were mined from three holes and most of this material was returned as backfill during reclamation. During mining of the first two holes, ground water was pumped out of the cavity, and roof collapses occurred. In the third hole both complete excavation and backfilling were accomplished entirely underwater.

B. Market

Phosphate is an essential ingredient in fertilizer. Phosphate-based fertilizers are produced by combining phosphate rock with sulphuric acid. Texasgulf reports that the fertilizer industry consumes 70% of all phosphate production. Texasgulf (TGI) and North Carolina Phosphate Corporation (NCPC) are discussed here as examples as they presently own phosphate reserves in Pamlico County.

Rail cars are the principal carrier of products leaving the phosphate operations of Texasgulf in Beaufort County. Some products are shipped via barges to the port at Morehead City. Self-unloading barges are used with a capacity of 2200 tons. They carry dry phosphate materials down the Pamlico River and through the Intracoastal Waterway to Morehead City. Phosphoric acid is also shipped to export markets through the Morehead City port.

In the last 20 years the worldwide consumption of phosphate fertilizer has more than tripled to 33.6 million tons in the 1978-79 fertilizer year. The demand for phosphate is expected to increase by 50 percent by 1990. The latest expansion of phosphate operations in Beaufort County will raise production to about 1.9 million tons of marketable phosphate products annually.

Agrico's marketing territory encompasses the entire eastern two-thirds of the country, an area accounting for about 80 percent of total U.S. fertilizer consumption. Special emphasis is placed on the midwestern and southwestern corn and wheat belts.

Improved prices for both fertilizer products and phosphate rock, combined with record worldwide fertilizer sales volumes caused Agrico's revenues to increase by 28 percent in 1980. In early 1981, Agrico formed a partnership with a French fertilizer company which will acquire 19 percent of the North Carolina mine. The French company will purchase 700,000 tons of the mine's annual production.

The major concern facing fertilizer companies will be cost increases that are anticipated, particularly for energy and raw materials, such as sulphur. Phosphate mining and the value of phosphate-based fertilizers will be dependent on the increased trend of using fertilizers, particularly a growing export market, and the fluctuating value of the dollar.

C. Impacts

Any discussion on the environmental and socioeconomic impacts of phosphate mining in Pamlico County must be prefaced by the fact that technologies are changing; impacts now associated with mining activity may in the next 10-30 years be alleviated and/or new impacts created based on new techniques. The following discussion will concentrate on the impacts of present strip-mining techniques and some of the impacts of slurry borehole mining that have been discovered.

Economic

Employment --The best example for Pamlico County is to refer to the ongoing activity just to the north in Beaufort County. In 1981, employment at the phosphate mine and chemical operations of Texasgulf in Beaufort County totaled more than 1,500. An expansion underway, costing \$180 million, will bring the employment total to 1,700 with a payroll of more than \$32 million each year.

North Carolina Phosphate, to begin operations will employ about 800 workers. After the construction period a gradual decline in this number will occur. The nearly 500 employees required during full operation will earn \$5.4 million per year, based on an average hourly wage of about \$5.50. Indirect jobs resulting from the project will equal as many as 600 during construction and 320 during operation. Half of these jobs will accrue to the surrounding counties including Pamlico County.

Research Triangle Institute (RTI) has estimated that about two to four jobs will be generated in Beaufort, Craven, and Pamlico Counties and the port at Morehead City for every ten jobs created at the mining site (1975).

Taxes: Texasgulf presently pays \$1.3 million annually in property taxes to Beaufort County. NCPC has estimated that, upon completion, their facility will yield \$1 million annually in property tax revenue. Land holdings of NCPC should generate an additional \$15,000 in annual taxes.

The one percent local share of sales tax that is levied by Beaufort County could yield \$65,000 in revenues during construction and nearly \$20,000 annually during operation from NCPC.

Land being held by the mining companies but not in active use is valued at about \$800/acre in Beaufort County. Improved farmland has a value of about \$2000/acre. Land being mined is valued at between \$2,000 to \$3,000/acre. No mineral taxes are levied because it is difficult to show how much phosphate is in the ground and hence place a value on it.

Intergovernmental transfers from state and federal sources to Beaufort County slightly increase as a result of mining endeavors. Most grants are made on a basis of county population, school enrollment, highway miles, local taxes collected, or poverty incidence.

It is not clear and will not be clear until the development of the phosphate deposits in Pamlico County is much closer at hand where the minerals will be processed. With large capital investments now in place in Beaufort County, it is reasonable to assume that Texasgulf and NCPC would attempt to utilize their existing processing plants and simply transport the minerals to Beaufort County for processing. This of course would mean that the economic benefit to Pamlico County would be diminished tremendously.

Social: In general, the labor force in the coastal counties is capable of absorbing employment opportunities generated by mining companies. During construction there may be a shortage of workers skilled in mine preparation. Usually, when this occurs, workers outside the area are recruited.

The long-term nature of the employment situation allows for extensive training programs, the skills required being within the capabilities of the county's workforce. Particularly with any new technologies, for example bore-hole mining, experience with equipment and technical data requires training and most likely recruitment from out of the county.

During full operation, usually some percentage (10-20% typically) of the workforce is hired from outside the project area. There may also be some internal migration for those workers wishing to relocate closer to the project site.

Many relocated residents near Aurora working for Texasgulf reside in mobile homes. About 20% of those surveyed by a town study team lived in mobile homes. For those areas supporting particular project sites, it may be appropriate to develop alternative growth plans to help guide future residential and commercial development. The presence of construction and mining activity as well as additional housing may create a need for increased service in those particular areas of the county.

Those areas of the county where mining interests hold property include the northwest and northern sections. Potential mining activity to take place in these areas would be centralized in already established offices in Beaufort County. Some growth pressure on the surrounding area, particularly Bayboro and Alliance, could occur.

Assuming, however, that the phosphate in Pamlico County will not be developed until after the Beaufort County resources are depleted, then little or no population growth would occur since the present employees could easily commute to the new site or sites.

Transportation: Texasgulf Corporation ships phosphate rock by barge to Morehead City, from which point shipments are made to foreign and domestic producers. North Carolina Phosphate Corporation will soon be following much the same pattern. Rail service to the site is the primary means for delivery of equipment and materials. NCPC plans construction of a rail spur off the existing Southern Railway trackage that leads to the Texasgulf facility.

On-site road construction and some improvement of off-site roads is necessary to ease the increased traffic, as some delivery of materials is made by truck as opposed to rail. Highway 306 is the major road from Pamlico County into Beaufort County, and the site of Texasgulf and NCPC regional offices. It is likely that these sites will remain as central to mining activity in the region. Highway 306 may carry many of the mining employees and much of the materials back and forth between the two sites.

Water

Groundwater: Phosphate has been mined at Lee Creek in Beaufort County since 1965 by Texasgulf. The dewatering of the Upper Castle Hayne Aquifer, which is the major source of water for the area, is necessary to allow dry pit mining at Lees Creek and has significantly affected the groundwater regime for hundreds of square miles surrounding the mine. There is much concern about the potential damage to groundwater in the Beaufort County area by pumping very large amounts of water to allow dry pit mining. Potential damage could include saltwater intrusion from the Pamlico River.

The average withdrawal from the Upper Castle Hayne Aquifer by Texasgulf is over 60 MGD. The decline in water levels throughout a 1,400 square mile region caused, in the early 1970s, the replacement of about 800 shallow well pumps. TexasGulf voluntarily bore most of the associated costs.

Groundwater is moving vertically and laterally from all directions toward the pumping center at Lee Creek. High chloride water is moving toward the pumping center, but there's disagreement as to the rate of movement and its impact.

The Environmental Management Commission granted a revised permit to TGI in 1976 to withdraw a total of 67 MGD and NCPC to withdraw 35 MGD from the Upper Castle Hayne. The total authorized maximum pumping at the operating TGI and NCPC mine sites will be 102 MGD.

Surface Water: The action which has the most significant hydrologic effect on surface waters is the clearing of mining blocks of about 150 acres in preparation for actual mining. Depending on the lag time between clearing and mining, this action will produce (1) the potential for increased runoff, (2) increased floodflows, and (3) increased erosion.

Construction and use of a clay pond dike and the resultant impoundment is done in order to dewater the waste slimes in preparation for reclamation. Discharges from the clay pond could produce increases in nutrients, TDS, and flotation process chemicals (fuels, oils, fatty acids). After 5-6 years the clay pond is no longer used and the clay slurry is directed to the mined-out pits. Water from the slurry is discharged with the depressurized water from the mine site into nearby streams.

The mine depressurization water, pumped in order to dry out the mine sites, varies by season in temperature, TDS, and salinity. This causes some alteration of the water at the discharge point.

There is also a danger of water pollutants escaping from a processing plant. Texasgulf was recently fined \$6000 for discharging phosphoric acid and sulfuric acid into the Pamlico River.

Air

Operations during site preparation and plant construction produce particulate and gaseous emissions. Road traffic, land clearing, burning of residue, and equipment operation will combine to increase pollutant output, but these levels should not affect nearby vegetation.

In the milling process, phosphate ore is reacted with sulphuric and phosphoric acids to enrich the phosphorus values of the ore and to break down the persistent calcium and fluoride ions associated chemically with the ore. As a result of this process, gaseous fluorides, sulphur dioxide and sulphuric acid mists are emitted as wastes. Calcium sulphate (gypsum) is also produced and stockpiled as a solid waste product which in conjunction with the accompanying gypsum waste water ponds, constitutes another source of air pollution.

In March of 1982, Texasgulf was fined \$37,000 by the State of North Carolina for 38 violations of clean air requirements by exceeding the sulfur dioxide emission limitations. The complex regularly emits about 21,000 tons of sulfur dioxide a year but had been emitting something in excess of this. The violation was predicted by computer modeling and detected by monitoring devices surrounding the plant, but the investigation was triggered when damage to vegetation around the plant was observed. This was the largest air pollution penalty ever levied by the State and took into consideration "the gravity of the violation, degree and extent of harm, cost of rectifying the damage and the amount of money saved by the violator by not complying with pollution control requirements."

North Carolina Phosphate Corporation has been required by the state Division of Air Quality to complete an extensive permitting process in order to operate in Beaufort County. NCPC cannot add significant emissions of sulphur dioxide in their processing because of the TGI emissions in the same air quality control region. Consequently they have had to design their plant for minimal emissions in order to comply with ambient air quality standards for the region.

Radiation

A project was conducted recently at the Texasgulf site in Beaufort County to evaluate radium 226 and radon 222 concentrations in the ground and surface water. Phosphate deposits contain appreciable concentrations of radioactive nuclides which originate from the decay of natural uranium in the ore. The project studied ground and surface water in the area around the mining and manufacturing facility. This facility has a number of high-capacity wells which are pumped continuously to lower the water table by 200 feet to below the level of the ore.

At the TGI plant, once mined, the separated phosphate rock is treated by the "wet process" method in which the ore is reacted with sulphuric acid to produce phosphoric acid and gypsum, a waste product. The waste gypsum is rinsed with a weak acid and water, discharged to a slurry tank, and finally pumped to large piles along the eastern perimeter of the plant. The slurry water is then decanted and recirculated to the slurry tank.

Several EPA studies have indicated that there is a partitioning of uranium and its decay products during the sulphuric acid reaction. Virtually all of the uranium remains with the phosphoric acid and subsequent fertilizers, while the major portion of the radium and subsequent daughters are separated out in the solid waste gypsum.

The present investigation was to determine the concentration of radium 226 and radon 222 in the water supplies adjacent to the plant, upstream and downstream of the plant in the Pamlico River, and determine the potential hazard of drinking water in this area.

The results of the study indicated that the majority of the wells sampled had only minute concentrations of radium 226 and radon 222. However, four wells were found to yield very high concentrations, still though at a level under the Federal Radiation Council's recommended exposure limits.

A problem in the study was that no tests could be made of radium and radon in the area prior to the mining and milling operations. Due to the abundance of phosphate ore in the area, high concentrations of radium and radon may be the result of natural distribution. The state Division of Human Resources, Radiation Protection Section, is continuing to monitor the TGI site and has begun monitoring at the NCPC site. Their work also includes soil and air samples, which the Division of Environmental Management has been assisting with. Air sampling within the facility takes place eight hours per day.

Water sampling is on a semi-annual basis. There are some funding problems though, which question the continuance of adequate monitoring and sampling at both sites.

Aesthetics

Phosphate mining--presently, strip-mining--leaves behind a scarred landscape. Strip-mining peels away the topsoil and overburden removing all vegetation, topsoils, sands and clays which rest over the phosphate ore. Some land reclamation programs are lessening mining's impact on the land, but reclamation cannot restore the land to its virgin state. The coastal wetlands, valuable as habitat to a wildlife population, cannot be returned.

At every step of the mining process, sands, clay slimes, waste water, and radioactive byproducts are discarded. According to the EPA, there are approximately 3,250 pounds of sand tailings and 2,110 pounds of waste clay slimes left on the average as the result of producing one ton of marketable phosphate rock.

The sand tailings impounded will result in the creation of an area which will be available for primary succession but will be difficult to revegetate. The absence of organic matter to act as a binding material and retain water and minerals among the sand particles will result in the rapid loss of these components by the surface layering of tailings.

The storage of clays during the initial years of mining will result in the creation of a layer of these materials up to 25-feet thick. Due to the drastic difference between physical and chemical properties of the clays and the sandy soils which will be overtopped, it is doubtful whether the exact floral communities presently occurring will ever be restored.

The reuse of these basin lands is generally limited to agricultural pursuits because of the bearing strength limits within these areas.

Wildlife

Some of the very same problems associated with peat mining operations and wildlife are also associated with phosphate mining. The problem of habitat loss during site preparation and plant construction puts pressure on the wildlife population and its diversity.

Several species on the federal list of endangered and threatened wildlife occur in the region where NCPC and TexasGulf are situated: Southern Bald Eagle, American Peregrine Falcon, Eastern Brown Pelican, Red Cock-aded Woodpecker, Bachhn's Warbler, American Alligator, Eastern Cougar, and Shortnose Sturgeon. There are additional species threatened that are on the North Carolina endangered species list.

Reclamation of mined lands will make these areas available once again for pasturing, but these pastures will not provide the habitat requirements of most native species of wildlife.

The extent to which native species migrate to other areas will determine their survival.

Forestry and Agriculture

During the clearing operations preceeding any mining activity, marketable trees are salvaged by timber companies. Unmarketable vegetation is burned in accordance with Forest Service regulations.

Reclaimed land, as experience in Florida bears out, is suitable for timber production or grazing. With specific fertilization the land should support row crops.

Forest resources harvested on the NCPC property are estimated to be worth \$2.8 million. Thus far, the lands owned by Texasgulf and NCPC in the county are minimal (approximately 20,000 acres) and the withdrawal of lands now in agricultural and silvicultural use would not be great. Potentially a larger impact would occur if other mining interests acquire interests in land in Pamlico County.

Slurry Borehole Mining

Surface subsidence and the occurrence of tailings piles are the major potential adverse environmental impacts of borehole mining operations. These problems are being attacked by injecting the ore tailings back into the hole.

A 1980 Bureau of Mines report presents the results of a demonstration of the technical, economic, and environmental feasibility of hydraulic borehole mining of shallow oil sands. Ground subsidence and water quality were carefully monitored through site surveys.

A series of site surveys which collected information on site ground elevations were documented weekly for two months. The average change in elevation was between one-quarter and one-half inch of subsidence, although some points were found to be slightly elevated rather than depressed. It appears that minor ground subsidence increased with time and decreased with distance from the boreholes.

The small ground-level subsidence that occurred over these 500-ton borehole cavities indicates that there would be significant subsidence over a 5000-ton cavity. Backfilling the cavity with the tailings produced in mining offsets both the subsidence problem and disposal of the tailings. More than 90 percent of the sand originally mined was backfilled into the cavity.

Water quality monitoring generated inconclusive data. The chemical composition of the water varied throughout the study. It appeared that the

total mineral content of the water increased slightly with time after its contact with the oil sands during the mining process. The total dissolved solids and chloride levels followed the same pattern. Some of the increased concentrations of salts are attributable to evaporative losses in the slurry pond. It is necessary to add an average of 12,000 gallons per day to the slurry pond to make up its 200,000-gallon capacity.

Based upon the data generated thus far, it is impossible to draw any conclusions with regard to water quality. Additional refining of the borehole mining technique and sampling strategies are needed before wide-scale use will occur.

Chapter 4

EXISTING POLICY AFFECTING PEAT HARVESTING AND PHOSPHATE MINING

Introduction

The following sections describe existing state policy with regard to peat and phosphate mining, and suggest problems for further consideration. A short discussion of federal, state, and local policy making roles looks at how the county can influence its future. Finally, three policy options are described in more detail: environmental impact statements, taxation, and land use regulation.

Until a major phosphate deposit was discovered in the state in the mid-1960s, officials did not consider North Carolina a mining state. Consequently little attention was paid to the strengths and weaknesses of mining taxation and regulations. It is only recently that the scale of mining has increased such that its impacts--economic and environmental--merit our full attention.

The next sections summarize the policy discussions that have gone on at the the state and local levels in any attempt to look at mining, or more generally, depletion of natural resources, in the context of its increasing local and statewide impacts.

A. Description of Policy

The Mining Act requires a permit for any land-disturbing activity that affects one or more acres and includes one of the activities mentioned in the Act. This broad definition of mining found in N.C. Gen Stat. §74-49(7)

clearly includes peat and phosphate mining. The Act provides for the protection of the surrounding environment and for reclamation of the land and water affected by the mining operation.

Various air and water quality permits are also required. Burning associated with clearing lands in preparation for peat mining may require a permit. The permit is required to do any burning in or within 500 feet of any woodland under the protection of the Department of Natural Resources and Community Development.

An air quality permit may be necessary for a phosphate processing plant. The permit places emission limitations on certain air pollutants emitted by the calciners, boilers, coal handling, and phosphate rock handling equipment.

A National Pollution Discharge Elimination System (NPDES) permit is required for a phosphate processing plant to control the discharge of wastes into the waterways. Permit terms may include monitoring, reporting, data collecting, and other methods necessary to its purpose.

Phosphate mining requires federal and state dredge and fill permits to control discharge in wetlands, estuarine waters, tidelands or marshlands.

A water use permit may also be necessary, particularly for phosphate mining and processing. This permit is required for any person who withdraws, obtains, or utilizes surface water or ground water in excess of 100,000 gallons per day in an area designated as a capacity use area. The permit approves the purpose of the withdrawal or use and may require monitoring, reporting, and water level controls.

A fuller description of all necessary permits and existing policy affecting peat and phosphate mining is included in the Appendix. The following sections look closely at existing policies and identify gaps and areas for further consideration. As the scale of both peat and phosphate mining increases in the coastal areas, new problems are created and old ones

are exacerbated. State officials are taking a new look at activities on the coast and have begun to identify policy issues needing further clarification. Some of these issues are covered in the next section.

B. Existing Policy: Peat Mining

Peat mining, in combination with agricultural conversion, on the coastal plain will have the following impacts:

- elimination of existing wildlife habitats
- elimination of representative natural ecosystems, critical to the survival of native plants and animals
- deterioration of water quality and habitats of aquatic wildlife
- reduction of certain recreational opportunities, particularly hunting and water-based recreation.

There are no state statutes for designating specific lands to be protected from mining or other development uses, and to be preserved in natural conditions. North Carolina needs to establish a state policy for its wetlands, beginning with a thorough ecological and economic inventory. Following is a list of needed research and possible regulations and incentives to ease the impacts of wetland conversion.

Wildlife Considerations

- The state Department of Natural Resources and Community Development should seek authority to designate certain areas as "critical habitat" for officially recognized endangered or threatened species.

- The Department (NRCD) should establish standards on which to assess and safeguard water quality necessary for aquatic wildlife (adversely affected by nutrient, sediment, and pesticide runoff).

- The Department should establish mitigation policies and requirements, by which adverse changes or loss of public natural resources can be compensated for, avoided, or minimized.

- The Department should seek extension of the state Environmental Policy Act to cover major projects with significant impacts which require state permits or licenses.

Inland Fishing Considerations

Methods of harvesting peat involve land clearing practices which are known to affect water quality. During and after peat harvest, water runoff rates will increase significantly. Also, the areas where peat harvesting is proposed are only a few feet above sea level. A third problem that may arise is saltwater intrusion. It is possible that saltwater intrusion may occur to the extent as to contaminate inland freshwater areas.

- More attention should be given to vegetative cover and soil and runoff retention practices. Minimum five-foot buffer strips along drainage ditches, groundcover crops, and no-till cultivation practices are some suggestions for mitigating runoff problems.

- Appropriate subsidy incentives for soil and water conservation should be made, but sediment control practices should be compulsory both during and after peat harvesting.

- Freshwater runoff from peat mining operations should not be discharged into estuarine primary nursery areas. Marine Fisheries policy staff should advise where discharges would have a minimum impact.

- Mining should be prohibited in stream valley deposits and in floodplain peat deposits along major rivers.

- There should be a moratorium on peat mining in areas where the bottom of the peat deposit lies at or below sea level until adequate environmental safeguards are developed.

- Drainage of pocosins should be covered under the state Dredge and Fill permitting procedure.

Monitoring and Reclamation Considerations

A full review of what constitutes approvable reclamation is needed. Mining permit applications thus far have proposed row-crop agriculture as reclamation, and forestry is expected to increase in popularity as an alternative. Whether freshwater or brackish impoundments ought to be part of a reclamation plan and how to incorporate the preservation of wildlife habitat should be examined.

- Develop a clear policy on requirements for reclamation and monitoring of reclaimed land once the land is released from the control of the Mining Act.

- A monitoring system of peat mining impacts needs to be established. An applicant for a mining permit for a peat mine should be required to submit a proposed monitoring plan as part of the application.

- A monitoring system to measure on-site and regional impacts needs to be established under the Department of Environmental Management or the Department of Natural Resources and Community Development.

- A mechanism to ensure wildlife mitigation measures will be continued on reclaimed land despite ownership changes.

C. Existing Policy: Phosphate Mining

Many of the same impacts associated with peat mining are also true of phosphate mining; land clearing activities which increase the potential for additional runoff, floodflow, and erosion problems are probably the most severe, and these impacts become water resource problems. Other environmental impacts of strip mining phosphate include:

- Potential damage to groundwater supplies by saltwater intrusion.

Groundwater is a major drinking water supply source.

- Violations of clean air requirements, particularly sulphur dioxide
- Elimination of existing wildlife habitats
- There is also the problem of reclamation. The land cannot be restored to its former state. It can be, and typically is, reclaimed as agricultural land, but the original vegetation and wildlife in most cases is lost.

Following are a list of considerations which point up some of the environmental issues surrounding the mining of phosphate. Most of the issues mentioned previously with regard to peat mining are applicable to phosphate mining as well.

- Although water quality is a factor in approving or denying a permit, water supply or availability is not.

- Monitoring capabilities of the state are not sufficient for the water, air, and radiation monitoring necessary on and off the mining site.

- There are no state statutes which protect critical or sensitive areas from mining including waterways, watersheds, wetlands, and other areas subject to damage by mining and major earthmoving activities.

- Reclamation plans need to be more specific, better guaranteed, and more closely aligned with original character of land.

Chapter 5

NATURAL RESOURCE DEVELOPMENT POLICY

Introduction

The peat and phosphate deposits that exist in the county are likely to be developed at some point in time. Peatco, a company based in Edenton, North Carolina, has already received a permit from the state to harvest peat in the Light Ground Pocosin. The company is presently exploring the market for peat.

Phosphate mining interests within and outside North Carolina have shown interest in the phosphate known to exist in the county. New mining techniques will increase the value of these deposits by making their extraction simpler.

In making a decision to mine these resources there are a number of trade-offs, primarily environmental, to consider: How will peat and phosphate mining affect the land, air and water resources in the county? A second concern is one of simple economics: Will development of natural resources in the county bring jobs and tax revenues?

The trade-offs involved in a decision of this type are continuous. The more lands that are committed to development, the greater the impacts. The key decision to be made is how far development should proceed.

Present competing uses of coastal lands include peat mining, agricultural production, seafood production, silviculture, phosphate mining, recreation, and wild land preservation. An increase in one of these uses is bound to have an effect on another. Increasing use of lands for agriculture and mining will limit the amount of land available to recreation and wild land preservation and so on.

This depicts some of the environmental effects the maximization of peat mining and phosphate mining will have on the other land uses. It points up the need for a good understanding of both the environmental and socioeconomic impacts of development of coastal lands. There are a number of intangible impacts large-scale land developments have on communities. These are less easy to define and quantify. They include the interests of future generations, community cohesion, sense of place, and generally, the social fabric of communities.

Policy for Natural Resource Development in Pamlico County

Pamlico County is blessed with a great many natural resources: clean air, good agricultural land, a good water supply, forests, productive wetlands and estuaries, varied wildlife, abundant natural beauty, and peat and phosphate deposits.

The economic, social and spiritual well-being of the people of the county has depended on sustaining the quality and quantity of these resources since the county was first inhabited.

This dependence is expected to continue, and probably to increase, as the rising demand for food increases agriculture, aquaculture and fishing in the county and as the rising demand for recreational facilities increases second home development, recreational fishing and recreational boating in the county.

The development of each of these natural resource is related to all of the others and can have an immediate, serious, and long-lasting impact on one or more of the others. Impacts on the local economy can be easily measured in fiscal or monetary terms, but impacts on the social and spiritual well-being of the people may be of equal or even greater importance even though they are

difficult, if not impossible, to measure in fiscal terms.

It is the policy of Pamlico County to encourage the development of the natural resources of the county, provided that such development will not have a serious negative impact on other natural resources. It is especially important that the development of a non-renewable resource does not hinder the development or continued use of a renewable or on-going resource, such as farm land, forest land, or the estuaries.

The development of natural resources should also make a positive contribution to the economic, social and spiritual well-being of the people of the county.

Thus, the development of the peat and phosphate deposits in the county will be encouraged only if doing so will not hinder the development or continued use of other natural resources and will contribute to the economic, social and spiritual well-being of the people of the county in both the near and distant future.

Specifically this means:

1. that once the peat or phosphate is removed, every effort should be made to leave the site in such a condition that it can be used for another activity benefitting the county or can return as close as possible to its natural state;
2. that the removal of water from the site should be done in a way that will not interfere with the natural function of wetlands, estuaries and the like;
3. that the quality and quantity of ground water should not be affected;
4. that the quality of the air should not be adversely affected;

5. that the development of the resource should have a positive fiscal impact on the county in both the short- and long-term;

6. that every effort should be made to protect the natural beauty of the county during and after the development process.

Chapter 6

OPTIONS AVAILABLE TO IMPLEMENT NATURAL RESOURCE DEVELOPMENT POLICY

Introduction

Of the three levels of policy making that the county can influence--federal, state, and local--the local level can be affected most directly. Federal policy controls what the county can or cannot do through federally mandated state regulations. The county's best opportunities with regard to federal policy lie in awareness and clear understanding of what regulations and guidelines permit. Through awareness, the county will be able to take advantage of federal policies and use them to their best end.

A. State Policy

State policy options and suggestions have perviously been commented on. It is only recently that the state has considered itself a mining state. In the mid-1960s, when phosphate rock was discovered in Beaufort County, the nature of the state's mineral wealth changed. Exploration and mining activity, particularly with respect to peat and phosphate, has increased considerably. The state is taking a new look at previously enacted statutes and also at what the voids in these regulations are.

The increase in peat and phosphate mining and the environmental and economic impacts of this development activity is forcing state officials to look closely at threats to water quality, wildlife habitats, and wetland values. The North Carolina Mining Act was amended by the 1981 General Assembly, and a peat mining task force submitted its first report to NRCD in March 1981 and is preparing to do an update this year.

The county can have influence in state policy making with regard to peat and phosphate mining. One example is the "North Carolina Severance Tax Act" (H.B. 1383). The General Assembly is now considering a severance tax proposal. The county can play an active role in lobbying for its adoption (see discussion below on severance tax).

The water quality and wildlife issues mentioned in a previous section are issues which the state is presently working on. The county can be a part of these discussions and strategy sessions necessary to come up with policy options and plans. Local officials can identify issues and suggest policy areas that need to be explored and strengthened.

B. Local Policy

The steps the county takes to protect its natural resources will be the best insurance to influencing and guiding mining and development. Three particular tools the county might choose to use will be discussed here: the environmental impact statement, taxation, and land use regulation.

Local Environmental Impact Statement

In 1971, the General Assembly passed the Environmental Policy Act (N.C. Gen. Stat. §113A-1 et seq). The main thrust of the Act seems to be a requirement for an Environmental Impact Statement for any proposed public action, similar to the Federal Act. However, §113A-8 allows local governments to require an EIS from "special purpose units of government" and private developers of "major development projects." "Special purpose units of government" are generally exempt from the state reporting requirement (§113A-9(3)) as are private developers not using public funds (§113A-4(2)). Thus, local governments may require an EIS from developers that the state act does not reach if they are developing a "major development project." This term is defined in

§113A-9(1) as including, but not limited to, "shopping centers, subdivisions, and other housing developments, and industrial and commercial projects. . . ." The all-inclusive nature of this definition is substantially limited by an exclusion of any project of less than two contiguous acres. The contents of the local EIS are to conform with those of the state, which are set forth in §113A-4(2).

The towns of Chapel Hill and Holden Beach have taken advantage of this enabling legislation. The statements required by, as well as the applications of, the two ordinances are quite different. The Holden Beach ordinance is somewhat simpler and will be examined first.

The EIS required in Holden Beach must set forth the same information required under the state act. This puts the Holden Beach ordinance in complete compliance with the enabling statute. The required factors are:

- environmental impact of the proposed action
- unavoidable adverse environmental effects
- proposed mitigation measures to minimize impact
- alternatives to the proposed action
- relation of short-term uses and long-term productivity
- any irreversible and irretrievable environmental changes involved

The ordinance includes two more examples of "major development projects," but does not exceed the statutory authority of §113A-8. The ordinance also lists some examples of "projects significantly affecting the quality of the environment," which is not done in the state statute. A public hearing with advertised notice is required on the EIS. The ordinance is enforced by making compliance with the ordinance a prerequisite for obtaining other permits.

The Chapel Hill ordinance is more comprehensive and arguably oversteps the authority granted in the enabling statute. First, the two acre exclusion in the definition of "major development project" is only applicable to residential projects. At the same time, the ordinance confines itself to the state definition of major development project. Secondly, the ordinance requires information not specifically mentioned in the state statute. Information required includes:

- a description of the land and its present use along with the expected impacts on other land within one-half mile of the development in the following categories: traffic, stream quality, wildlife, noise pollution, impoundment of water, energy and other utility use, and other significant impacts
- a description of impact on scenic, historical, or cultural qualities of the town
- description of impact on wildlife, natural vegetation, erosion, and sedimentation
- description of efforts proposed to minimize adverse impacts
- a statement reflecting intention to comply with all ordinances applicable to the development
- comments from all agencies with jurisdiction or expertise in areas to be affected by the development (apparently solicited by developer)
- description of methods proposed by developer to minimize energy consumption.

Despite the "extra" requirements, the ordinance goes on to say that an EIS prepared in accordance with state or federal requirements will be deemed adequate under the ordinance. Notice of receipt of the EIS must be published, but a public hearing is not required. The ordinance is enforced by making the receipt of the EIS, along with the publication and a review period, prerequisites to the letting of any other necessary permits or approvals. There are several exceptions to the ordinance, most notably single family dwellings and duplex dwellings.

Taxation

A business tax, severance tax, or property tax is a way for a county to collect revenue to pay for expanding services. These are discussed separately below.

Business Tax: The state has the power to levy a license tax on certain businesses. N.C. Gen. Stat. §105-33 through §105-102.3 lists which businesses can be taxed. Mining operations are not mentioned.

N.C. Gen. Stat. §153A-146 allows counties to impose those taxes specifically authorized by the General Assembly. Section 153A-146 then authorizes counties to tax businesses to the extent authorized by §105-33 et seq. Mining operations are not mentioned, so counties presently are unauthorized to levy a business tax upon them. Legislation would be necessary for counties to impose such a tax.

City taxation of a mining operation seems to be presently authorized if some part of the business is carried on within city limits. Of course, relocation of that business outside city limits is also a possibility.

The Legislature has authorized cities and counties to impose a privilege license tax on hazardous waste facilities. The environmental and protective policies behind this effort should apply to a similar tax on mining operations.

Severance Tax: As mentioned earlier, the General Assembly is considering a severance tax bill. The severance tax would be assessed against the gross value of all minerals, including phosphate, peat, stone, sand, gravel, and other products, at the time they are removed from the ground. The suggested rate is four percent. The revenues produced from this tax could be used to fund environmental monitoring of peat and phosphate mining. The proposed

four percent severance tax on the gross value of all solid minerals would have generated \$14.4 million in revenues if applied to the \$360,893,000 in minerals produced in the state in 1980 (Siceloff, 1981).

Revenues from severance taxes are used for a variety of purposes around the nation. In Montana, North Dakota, Utah, and Wyoming, a share of the coal severance tax is channeled to communities where mines are under construction but are not generating tax revenues to fund the expanded public services they require. Florida uses part of its 10 percent tax on phosphate for mine reclamation.

The state is considering new ways to strengthen the budget. A severance tax on peat and phosphate would produce substantial returns.

Property Tax: Of the three taxes discussed, only property tax is controlled at the county level. Since peat and phosphate mining interests own such large parcels of land, the county should stand to profit on property tax revenues--if these revenues can offset the cost of necessary public services.

Texasgulf presently pays \$1.3 million annually in property taxes to Beaufort County. North Carolina Phosphate Corporation anticipates that, upon completion, their facilities will yield \$1 million annually in property taxes for Beaufort County.

If, when the phosphate deposits in Pamlico County are developed, the processing of this ore occurs outside the county, then revenues will be even less for Pamlico County.

Average land values for land held by peat and phosphate interests for undeveloped farmland is \$800/acre. No mineral taxes are levied because of the difficulty in determining how much phosphate is in the ground.

Land Use Regulation

A number of jurisdictions in and around North Carolina have created ordinances which apply only to major developments requiring a permit, or ordinances which apply to critical or sensitive lands.

Holden Beach and Chapel Hill have already been mentioned as towns which require local environmental impact statements from developers of major development projects.

In pursuing this a county could create regulations that would set standards for issuing a permit based on known potential impacts.

A second type of ordinance would be directed to sensitive lands. Manatee County, in Florida, has created a Special Treatment Overlay District to, ". . . provide additional protection for specific areas of, or resources in, the county that are especially sensitive to or subject to damage by industrial, mining, or major earthmoving activities. . . ." The provisions of this district are operated in conjunction with other zoning requirements already applied to the property. The overlay requirements are a means of insuring that additional attention be given to developing particular lands in a way which is sensitive to their natural processes.

An overlay district could be used, for example, to protect wetland areas by limiting uses, or allowing them with certain conditions. An overlay district protects those qualities of the land which make it attractive and useful, and assure that any development will be according to what the land can support.

